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# The FLORIDA ENTOMOLOGIST

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# A REVIEW OF THE HISTORY OF THE FLORIDA ENTOMOLOGICAL SOCIETY AT ITS FORTIETH ANNIVERSARY [1]

JOHN W. WILSON
Central Florida Experiment Station

Forty years ago on January 5, 1916, eleven men gathered on the campus of the University of Florida to organize the Florida Entomological Society. The objectives, as set forth in the constitution, were to promote the study of entomology, to distribute widely knowledge pertaining to insects, and to publish an entomological journal. The annual dues were set at 50 cents per member. Although this membership fee appears very modest at the present time, there was nothing modest about the vision and ambitions for the Society of those eleven charter members. They were aware of the great need for more entomological knowledge and through the Florida Entomological Society they proposed to stimulate a consciousness of this need in the mind of the general public. They also proposed to encourage the development of a body of amateur entomologists, as well as professionals, dedicated to the accumulation of more information about insects.

The list of charter members included Dr. E. W. Berger, President; H. S. Davis, Vice President; K. E. Bragdon, Secretary and Treasurer; Prof. J. R. Watson, Executive committee member; and C. J. Albrecht, H. B. Barnett, W. R. Briggs, A. C. Brown, H. G. Carter, Jeff Chaffin, Virgil Clark, R. H. F. Dade, L. A. Daniel, H. L. Dozier, H. D. Eikenberry, John Eiland, B. O. Gaston, J. C. Goodwin, J. E. B. Hall, N. C. Hainlin, S. P. Harn, Fritz Hatcher, F. E. Haywood, J. C. Holton, C. M. Hunt, K. F. Innecken, H. H. Lawley, A. C. Mason, J. A. Miller, J. H. Montgomery, Wilmon Newell, F. C. Nieland, F. M. O'Byrne, F. W. Poos, E. R. Potter, Mrs. N. M. G. Prange, W. J. Rahn, P. H. Rolfs, H. E. Schumacher, Frank Stiriling, A. L. Swanson, G. E. Tedder, T. Van Hyning, M. C. Vaughn, Shirley Walker, C. E. Wilson, G. H. Wilson, R. N. Wilson, S. L. Woodruff, W. W. Yothers.

The members held monthly meetings in Gainesville. At the April, 1917, meeting Dr. E. W. Berger proposed that the Society undertake to publish a periodical to be known as the FLORIDA BUGGIST. Professor J. R. Watson was selected to be editor and he continued to serve the Society in this capacity until his death in 1946. Three volumes were published under the name FLORIDA BUGGIST. With volume 4, number 1, the name of the publication was changed to THE FLORIDA ENTOMOLOGIST. During the 30-year period that Professor Watson served as editor, he often served also as financial underwriter of the Society and its periodical. There were times, particularly during the 1930's, that Professor Watson advanced money from his personal funds to make publication of THE FLORIDA ENTOMOLOGIST possible. There were other strong friends who came to the aid of THE FLORIDA ENTOMOLOGIST during these trying times. Among those who were outstanding in this connection were the Pepper Printing Company and the Tobacco By-Products and Chemical Corporation. The Pepper Printing Com-

[1] Presented at the 40th annual meeting of the Florida Entomological Society.

pany extended credit for publication costs and was very patient over a period of several years while these accumulated bills were being gradually paid off. During this whole period the Tobacco By-Products and Chemical Corporation carried a full page advertisement. Without the income from this advertisement, continued publication would have been almost impossible. Due to a shortage of funds and sometimes a scarcity of manuscripts, it was occasionally necessary to combine two numbers of the journal. In spite of all these difficulties, Professor Watson skillfully managed to maintain the publication of a creditable entomological journal.

At the time of Professor Watson's death George Merrill was associate editor, and thus the full responsibility of continuing publication of THE FLORIDA ENTOMOLOGIST fell upon his shoulders. At the end of the term of office Mr. Merrill was succeeded by H. K. Wallace who filled this important post for three years. At the thirty-third annual meeting Lewis Berner was selected as editor. During the eight years of Dr. Berner's editorship, THE FLORIDA ENTOMOLOGIST has grown steadily both in the number and quality of the manuscripts published. The circulation has also steadily increased. In addititon to being received by the 251 members of the Society, it is subscribed to at the present time by 51 libraries in the United States and 25 libraries in foreign countries. In addition 28 overseas libraries receive THE FLORIDA ENTOMOLOGIST on an exchange basis.

Aside from the regular annual meetings, the publication of THE FLORIDA ENTOMOLOGIST is the only activity that the Society has engaged in during the past. However, the Society can be proud of the fact that members such as Professor Watson, Mr. Merrill, Doctors Wallace and Berner were willing to spend the time and energy required to maintain the high standards that THE FLORIDA ENTOMOLOGIST has attained. We can also feel confident that under the competent leadership of Dr. Berner our publication will continue to grow and to be recognized as a leader in its field. We should recognize the fact that the publication of THE FLORIDA ETOMOLOGIST is one of the most important activities that the Society can undertake and that each of us should support this activity to the fullest extent.

The enthusiasm of the founders of the Society was contagious, as was reflected in a very rapid growth in membership. During the first year it more than quadrupled its membership and by the end of 1917 there were nearly one hundred active members and twenty associate members.[2] They also inspired the organization in 1917 of the Lee County Entomological Society at Fort Myers which had a membership of twelve. Early in 1918 the Lee County Society affiliated with the Florida Entomological Society as a branch society.

Unfortunately the Society was unable to maintain a steady growth. However, it did continue to hold several meetings a year at irregular intervals. Meetings were frequently called when distinguished entomologists such as Doctors Herbert Osborn, H. T. Fernald, O. A. Johansen, W. S. Blatchley, and others visited the University of Florida Campus. The minutes of the Society, as published in THE FLORIDA ENTOMOLOGIST, frequently describe the papers presented at such called meetings during the 1920's and early 1930's.

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[2] Tissot, A. N. 1939. A brief history of the Florida Entomological Society. Fla. Ent. 22 (1): 8-9.

A history of the Florida Entomological Society would not be complete without some discussion of the outstanding entomological events that occurred during the period of its existence. These events had their effect upon the society and, therefore, demand recognition in its history. The first of these was the outbreak of the spirea aphid on citrus which occurred during the spring of 1923 and continued in outbreak proportions through the spring of 1925. This outbreak of the spirea aphid resulted in the employment by the Experiment Station of the first entomologist to be assigned to a location off the University of Florida Campus.

For a period of several years instruction in entomology and plant pathology was conducted in one department of the University of Florida College of Agriculture. This was still true in 1929 when John T. Creighton joined the University staff. Shortly after, instruction in these two branches was elevated to two separate departments and Dr. Creighton became the head of the Department of Entomology of the College of Agriculture. Under the sponsorship of the students and faculty of the Department of Entomology, the Newell Entomological Society was organized in 1935. This student organization has promoted an annual Entomological Conference and in many other ways has helped to advance the cause of professional entomology. Many of the members of this organization have first affiliated with the Florida Entomological Society as student members and have later become active members of the Society. Under the very able leadership of Dr. Creighton, the Department of Entomology has become strong and well rounded.

Another event which eventually had a profound effect upon the Florida Entomological Society was the phenomenal expansion experienced by the Experiment Station during the decade of the 1920's. The Citrus Experiment Station was authorized by the Legislature of 1917, provided donations of lands, groves, moneys, or other things of value be made to the Board of Control for this Station in the amount of not less than ten thousand dollars. It was not until April 6, 1921, that donations in sufficient amount to meet the legal requirements were received by the Board of Control. The Legislature of 1921 established the Tobacco Experiment Station at Quincy and the Everglades Experiment Station at Belle Glade. The tobacco experiment Station later became known as the North Florida Experiment Station. During the fiscal year ending June 30, 1924, two laboratories were established, one at Hastings for the study of diseases of potatoes, and one at Cocoa for the study of diseases of citrus. The first of these has recently become a Branch Station with an entomologist on the staff. The laboratory at Cocoa was discontinued some years ago. In 1925 a laboratory for the study of the diseases of strawberries was established near Plant City. Laboratories were established at Bradenton and Homestead in 1926, at Monticello and Sanford in 1927, and at Leesburg, Pierson, and West Palm Beach in 1929. The latter two laboratories were later discontinued, making a net total of ten new branch stations and laboratories established in various parts of the state during this decade. Although entomologists were not on the original staff of most of these new installations, there are one or more entomologists on the staff of all but two of them at the present time. Since 1929 five additional branch stations have been established but no entomologists have yet been appointed to these staffs.

The Florida State Plant Board was established with the passage of the Florida Plant Act by the Legislature of 1915. The first project of the Plant Board was the study of citrus canker to determine what measures should be taken for its control. As a result of these studies the citrus canker eradication campaign was undertaken. This campaign was successfully completed under Dr. Wilmon Newell's direction in 1929. Before the citrus canker eradication campaign was brought to a close officially the Mediterranean fruit fly was discovered in Orlando. Thus, from its beginning the Plant Board has played a major role in the development of the agriculture of the State. The many Plant Board staff members who have been and are at present members of the Society have also contributed greatly to the development of the Florida Entomological Society.

The Florida State Board of Health began its study of methods for control of mosquitoes soon after the yellow fever epidemic of 1877. However, it was not until after World War I that an organized effort was made in this direction. In 1941 Mr. John Mulrenan was employed and set up the Bureau of Malaria Control which was reorganized in 1946 and renamed the Division of Entomology. Under the enthusiastic leadership of Mr. Mulrenan the Division of Entomology, State Health Board, has recently dedicated a new laboratory located at Fort Pierce where a number of entomologists will be employed in the study of insects affecting man's health. Some of these entomologists have been with the Division of Entomology for several years and are well known for the active part they have taken in the affairs of the Society.

Another group which has contributed to the growth and well being of the Florida Entomological Society in recent years is the pest control industry. These well-trained entomologists have come into being as a group since World War II. The Florida Entomological Society recognizes the contributions the pest control industry are making to the welfare of mankind and is glad to welcome these men for the contributions they will make to the Society.

The Bureau of Entomology had established a laboratory at Orlando for the study of insects attacking citrus several years prior to the organization of the Florida Entomological Society. Mr. W. W. Yothers, who was in charge of this laboratory at that time, became a charter member of the Society and was elected to honorary membership in 1952, after having served as president in 1927. During the years of World War II, the Division of Insects Affecting Man and Animals established a large laboratory at Orlando and many members of the staff of this laboratory are now active members of our Society.

Early in the spring of 1923 an outbreak of the celery leaf tier occurred in the Sanford area. In 1924 the damage caused by this insect was not as great as in 1923, but the celery growers of that area suffered very heavy losses during the spring of 1925. This threat to the celery industry led to the establishment of a laboratory under the joint supervision of the State Plant Board and the Division of Truck Crop Insects of the Bureau of Entomology. A few years later this work was conducted entirely by the Division of Truck Crop Insects. The several staff members of this laboratory became members of the Society. Among these C. B. Wisecup served as Business Manager and Treasurer during the war years 1942 to 1946.

On April 6, 1929, specimens of the Mediterranean fruit fly were collected in a citrus grove near Orlando. Further inspections showed that this insect was widely established in the citrus producing area of the state. The energy and organizational ability displayed by Dr. Wilmon Newell in his attack of this problem resulted in one of the rare eradications of an economic insect in the remarkably short period of less than two years. Although this accomplishment was of tremendous importance to the citrus industry of Florida, it also produced developments that have influenced the whole profession of entomology. First there is the pride all entomologists can have in such an accomplishment. More tangible developments were the first extensive use of bait sprays and the first use of the vapor-heat treatment method for treating large quantities of fruit for shipment. Both of these methods have been adapted for use against other insects and to other plant products.

On April 13, 1956, the second infestation of the Mediterranean fruit fly was discovered when larval specimens were taken from Miami to Dr. D. O. Wolfenbarger for identification. As we will learn from papers on the program for this meeting the U. S. D. A. Plant Pest Control Branch and the State Plant Board are now actively engaged in the second Mediterranean fruit fly eradication campaign.

Another insect eradication campaign was undertaken by the State Plant Board in August, 1934, after the citrus blackfly was discovered in Key West on August 10, 1934. From the experience gained in the Mediterranean fruit fly campaign the Plant Board made every effort to win the whole-hearted support of the Key West citizenry. In spite of all efforts, the Plant Board was seriously hampered in its work by strenuous resistance on the part of many of the citizens. Only after a legal battle that was carried all the way to the Supreme Court was the Plant Board able to conduct the campaign properly. The delays caused by the resistance of the local citizens and legal proceedings increased the cost of the campaign considerably and postponed its eventual successful conclusion. The last evidence of the infestation was found on February 26, 1937, two and a half years after it was first observed.

During the early summer of 1947 an outbreak of the green peach aphid occurred on shade tobacco in Gadsden County. Although this aphid had been observed on tobacco at various times before 1947 it had not been considered an economic pest of tobacco. The infestation became so severe that two student entomologists were sent to the area. A little later three Experiment-Station entomologists were taken from their regular duties and temporarily assigned to this problem. The first field tests of parathion were conducted in this area in 1947. The first commercial formulations of this insecticide were used in this area during the spring of 1948. This outbreak resulted in the placing of an entomologist on the staff of the North Florida Experiment Station.

Most individuals and organizations experience periods of vigorous health and growth alternating with periods of poor health and depressed activity. The Florida Entomological Society was no exception to this generality. It was during the early 1930's, coincident with the depth of the financial depression, that the Society was in the poorest condition. Perhaps entomologists' preoccupation with the struggle for existence had its adverse

effect upon the health of the Florida Entomological Society. In spite of the phenomenal expansion of the Experiment Station which has been described, membership in the Society dwindled, meetings were held at irregular and infrequent intervals, and the financial condition was deteriorating. Credit for the reversal of these trends should go to W. L. Thompson who realized that the Society could not survive if this state of affairs was permitted to continue. As a result of his efforts to improve conditions, Thompson was elected president of the Society in 1936. He and the slate of officers elected with him were successful in injecting new life into the Society. These officers who ably assisted Mr. Thompson in this undertaking included R. L. Miller, Vice-President; A. N. Tissot, Secretary; J. R. Watson, Editor; E. W. Berger, Associate Editor; and J. W. Wilson, Business Manager. At this time the custom of holding a single annual meeting, was initiated. A renewed spirit was apparent at the 1937 annual meeting, with an excellent program arranged by the secretary and an attendance of 37 members.

Since this twenty-second annual meeting held in 1937, the Society has grown steadily to its present size and recognized position in the profession. The twenty-fifth annual meeting was held in Gainesville, December 13 and 14, 1940. The Silver Anniversary dinner, with Dr. H. Harold Hume as toastmaster, honored Professor Watson, the first president and editor of THE FLORIDA ENTOMOLOGIST from its first number. Of the eleven men present at the first meeting, four, Doctors Wilmon Newell and E. W. Berger, Mr. J. C. Goodwin and Professor Watson were present for this celebration of the twenty-fifth anniversary.

As has been indicated in previous paragraphs the Florida Entomological Society is composed of several groups of entomologists. All of these groups are engaged in the common cause of serving the general public in its continuing battle with the insects that are public enemies. At this point this common interest of these various groups is emphasized. The Florida Entomological Society provides a common meeting ground for all entomologists, the teacher, the systematist, the pure scientist and the economic entomologist. In an effort to promote the common interests of all entomologists the Society has stablished the policy, through practice, of rotating the office of president among the various groups.

At the close of World War II the release of D D T for civilian use stimulated a great demand for insecticides and the services of entomologists. The rapid release of the sythetic hydrocarbon and phosphatic insecticides has promoted a tremendous demand for men with entomological training. The large number of young men entering the profession of entomology in the employ of the insecticide industry has stimulated a rapid growth of the Society. This rapid increase in numbers, with the vigor and enthusiasm these young entomologists are bringing into the Society, is providing a new impetus to greater accomplishments. Now at this fortieth anniversary of the founding of the Florida Entomological Society, we can look forward with confidence to a bright future of broadened activity for the Society.

# THE DEVELOPMENT OF PUBLIC HEALTH SERVICE QUARANTINE ENTOMOLOGY AND ITS PROGRAM IN SOUTH FLORIDA

JOHN E. PORTER [1]

Guarding against the introduction of diseases from other countries is a responsibility of the Division of Foreign Quarantine of the U. S. Public Health Service. The Service has been charged with this duty since 1798.

Control measures against *Aedes aegypti* mosquitoes became an accepted Public Health procedure on ships with the discovery in 1900 of the relationship of this mosquito with the yellow fever virus. However, it was not until the early days of international air travel that Public Health quarantine entomology as such, had its inception. Even in these early days epidemiologists of the Service foresaw an era in which there would be increased dangers to our country through the possible importation of insects from foreign countries by airplane.

Their realization of this potential threat to our country led to the first reported studies of insects on aircraft. Griffitts (1931) inspected 102 aircraft arriving at Miami, Florida, from Central and South America and the Caribbean area during 1931 and reported the occurrence of 29 mosquitoes on 21 planes. This observation posed a logical question. Can insects survive at the high altitudes and cold temperatures in which planes fly? Subsequent tests by Griffitts (1933) demonstrated the ability of mosquitoes to survive for approximately 80 hours of flying time and at 14,000 feet altitude in these prototypes of the modern plane. Carnahan (1938) reported on insects recovered from aircraft at Miami, Florida, while Welch (1939) was the only worker up to that time to pay any attention to insects other than those of medical importance. Denning *et al.* (1947) and Hughes (1949) have admirably summarized the findings made by Public Health Service inspectors. Since those days much has been said of the accidental transport of insects in aircraft. Observations made today indicate that live insects, including mosquitoes, are frequently found on the modern planes which fly at higher altitudes and often for greater lengths of time than the early planes.

The knowledge that mosquitoes were able to survive at the altitudes these early planes sometimes reached in their international flights was cause for deep concern. It could have been pigeon-holed as just another observation in the gathering of scientific information, but, remembering the not too far removed outbreak of yellow fever in New Orleans, our officials were not anxious to allow foreign mosquitoes access to our shores. The development of heated and pressurized cabins further increased the possibilities of transporting live mosquitoes.

Consequently, studies were commenced to find the best way to prevent these insects from establishing themselves in this country.

The earliest control measures made use of hydrocyanic acid gas fumigations, rotenone dusts and formaldehyde sprays, but none of these were

[1] Entomologist, U. S. Quarantine Station, Miami Beach, Florida, Division of Foreign Quarantine, Public Health Service, U. S. Department of Health, Education, and Welfare.

satisfactory or safe. Williams and Dreessen (1935) developed a non-flammable pyrethrum spray for use on aircraft which was the first material applied extensively for the control of insects aboard aircraft.

Control measures devised since the introduction of this spray have pretty well run the ambit of insecticidal knowledge. Early applications of insecticide made use of the plunger-type hand sprayer, followed by the use of a compressed air sprayer. In 1942 Goodhue and Sullivan opened a new approach to insect control with their introduction of a method for dispersing pyrethrum in dichlorodifluoremethane, using this liquified gas as the propellent. This use of an *aerosol* has greatly simplified the problem of in-flight disinsection of aircraft.

Insect control procedures were incorporated in the Public Health Service Foreign Quarantine Regulations in 1941 requiring the disinsection of aircraft arriving in the United States "from any place in South America or tropical Africa, or from any other region where yellow fever may appear." Entomologists and trained inspectors were employed to carry out inspections on aircraft and ships and surveillance around airports and seaports.

The introduction of DDT revolutionized the field of economic entomology and this insecticide was soon made a part of the aerosols used on aircraft. Since its incorporation with pyrethrum in these aerosols little change has occurred.

Many hours of experimentation have gone into efforts to improve the existing formulations to make them more effective toxicants and less irritating to passengers and crew. Unfortunately, to date, there is no ideal aircraft formula.

Until recently two high pressure aerosol formulations, G-382 and G-651, were the only ones acceptable to the Public Health Service for aircraft disinsection. However, in July, 1955, two medium pressure aerosols, G-1029 and G-1152, were approved for this use. The following table indicates the percentage composition by weight of these formulations.

AEROSOL FORMULATIONS AUTHORIZED BY THE PUBLIC HEALTH SERVICE FOR USE IN AIRCRAFT.

| Ingredients | Percent by weight composition per formulations | | | |
|---|---|---|---|---|
| | G-382 | G-651 | G-1029 | G-1152 |
| Pyrethrum extract, purified (20% pyrethrins) | 5.0 | 6.0 | 6.0 | 5.0 |
| DDT (aerosol grade) | 3.0 | 2.0 | 2.0 | 3.0 |
| Cyclohexanone | 5.0 | — | — | 5.0 |
| Lubricating oil (SAE 30) | 2.0 | — | — | 2.0 |
| Dichlorodifluoromethane (Freon 12 or Genetron 12) | 85.0 | 84.0 | 58.8 | 59.5 |
| Aromatic petroleum derivative solvent: | | | | |
| (Velsicol AR60 or Socony-Vacuum 544G) | — | 8.0 | 6.0 | — |
| (Velsicol AR50 or Socony-Vacuum 544C) | — | — | 2.0 | — |
| Trichlorofluoromethane (Freon -11 or Genetron -11) | — | — | 25.2 | 25.5 |

Another method of spraying planes, *automatic disinsection*, was developed because of the frequent failure of crew members to properly dis-

charge their spray duties while their planes are airborne. Dr. C. S. White, then of the U. S. Navy, and Mr. D. L. Snow, Public Health Service, in 1945 experimented with the idea of piping an aerosol into all parts of a plane, this material to be released by simply pressing a control button or switch. In 1946, Snow and White conducted tests with the first automatic system at Patuxent River, Maryland. Cdr. John M. Hirst, U. S. Navy, devoted several years to improving this system (U. S. Navy, 1950) and was instrumental in the installation of the system in some Military Air Transport Service planes used during the Korean War. The method is not yet refined enough for use on civilian aircraft.

In the past few years efforts have been directed by the Communicable Disease Center laboratories in Savannah, Georgia, and the Division of Foreign Quarantine, Public Health Service, to the application of residual insecticides and the utilization of insecticidal vapors for insect control on aircraft. Lindane residues of 200 mg. per square foot have given satisfactory insect control of baggage compartments for up to 5 weeks, while lesser deposits in passenger compartments have given control up to 3 weeks. DDT and dieldrin as residuals have not shown much effectiveness.

Lindane and DDVP (dimethyl 2,2-dichlorovinyl phosphate) as vapors have been applied in some experiments. These vapors originate from insecticidally treated glass-wool filters installed in the ventilator systems of planes. Such use of insecticides as these shows promise of being the easiest and most effective method of disinsecting aircraft. Details of the toxic hazards to passengers and crew must be determined before this method may be generally used.

A search is still being made for a formula, as well as dispersing apparatus, which possesses all of the following characteristics:

1. It should be economical.
2. It should be non-irritating and non-toxic to passengers and crew.
3. It should be harmless to aircraft interiors.
4. It should be rapidly effective in its paralyzing and toxic powers on insects.
5. It should be applied automatically.
6. It should be light weight and free of maintenance problems.

Modern concepts of insect control are, however, varied and flexible. We do not depend upon the disinsection of planes and ships as our only expedient. It does not present the perfect barrier to insect introduction as might be supposed. Theoretically, only complete cessation of travel would give us a reasonably perfect barrier. Frequent entomological survey of those areas surrounding airports and seaports, is another method used by our station for the early detection and prompt eradication of any insects which may have unknowingly been introduced into this area. Mosquito light traps prove a useful adjunct to this surveillance program.

Routine inspection is made of airports and seaports and their surrounding areas for removal of conditions attractive to the breeding of *Aedes aegypti*. Our staff institutes control measures when actual breeding of mosquitoes is observed. Education of the public is an accepted principle in most types of control programs. Since airline crews are held responsible for the proper disinsection of planes, it is a practice of this station to

participate in their training programs. Instruction is given on the proper methods and procedures for spraying aircraft. Emphasis is given to two facts. First, it is usually easier to keep an insect out of the country than it is to eradicate it; and second, great dangers to the public are present if cases of yellow fever, plague, typhus, encephalitis or relapsing fever should be introduced. Not only do we stress our concern with insects of medical importance but those of agricultural significance as well. In fact, publicity concerning the recent introduction of the Mediterranian fruit fly, *Ceratitis capitata* Wied., in this area has impressed airline personnel of the necessity for thorough disinsection of all arriving aircraft. The receipt by all Public Health Service quarantine stations of intelligence reports dealing with epidemiological conditions throughout the world enable us to ascertain the degree of danger involved by air or marine traffic from these areas. Often routine insect control measures are intensified as a result of such information.

Thus, to be effective, quarantine control depends upon cooperation among governments and from several different agencies; cooperation of passengers and crew (in accepting in good faith and without complaint the disinsection of aircraft and ships); cooperation of airline and ship personnel and the federal agencies interested in the control procedures indicated by receipt of epidemiological reports; and cooperation among the federal regulatory agencies and state and county control authorities to detect and eliminate the breeding and breeding conditions conducive to the establishment of undesirable insects in this country.

The World Health Organization has exempted certain airports and seaports from the yellow fever endemic zone. They are like islands of safety surrounded by a sea of endemicity because breeding of *Aedes aegypti* is kept below hazardous levels. Some thought it being given to the possibility of making all ports of entry and departure free from insects of public health importance—i.e. sanitary ports. If such a dream could come true—and there is definitely more promise of it now with the great array of scientific and technical knowledge available—our quarantine problems would be greatly reduced.

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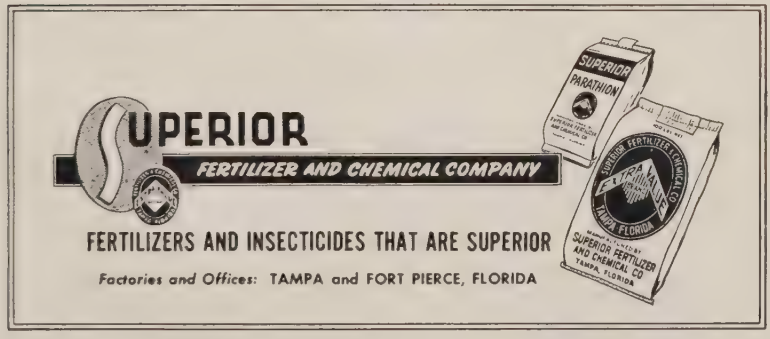

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# OBSERVATIONS ON THE MOSQUITO, *TOXORHYNCHITES RUTILUS RUTILUS* (COQUILLETT), IN ALACHUA COUNTY, FLORIDA

LEE D. OLINGER
Department of Entomology, University of Florida

*Toxorhynchites rutilus rutilus* (Coquillett) is a brilliantly ornamented, diurnal mosquito occurring in the southeastern part of the United States. It was recorded from Florida and Georgia by Howard *et. al.* (1912-17) and later from South Carolina by Carpenter and Jenkins (1945).

In Florida, larvae of *T. rutilus* have been taken in association with *Wyeomyia mitchellii* (Theobald) and *W. vanduzeei* Dyar and Knab from one of the bromeliads. *Tillandsia utriculata* Linn., by Seabrook and Duffey (1946). Basham *et. al.* (1947) collected larvae and pupae of this mosquito from rot cavities in water oak, live oak, orange, pecan, and pine trees, and in assorted containers under, or near trees.

Larvae of *T. rutilus* were reported to be cannibalistic and predatorial on larvae of *Aedes triseriatus* (Say) and *Orthopodomyia signifera* (Coq.) by Jenkins and Carpenter (1946). Basham *et. al.* (1947) reared three specimens, feeding them larvae of *A. triseriatus*, *O. signifera*, and *Culex quinquefascicatus* Say.

From 1954 to 1956 the writer routinely observed 19 rot cavities in trees at Gainesville, Florida. *T. rutilus* was commonly found in three large sweetgum cavities, and occasionally in a small cavity in water oak.

An aerial oviposition of a female mosquito, believed to be *T. rutilus*, was observed at 5:30 p.m., on August 10, 1954. While depositing, the female flew up and down about four to five inches above the orifice of a large, basal, sweetgum cavity, located on the western edge of a densely wooded area. In general, the flight was directed counterclockwise. Frequently the course of the flight veered, allowing eggs to drop on dry areas of the trunk, and on the ground. The female flew into the wooded area, following the deposition.

After the oviposition flight 136 eggs were counted; however, some may have been deposited by other females, and the observed female may have deposited in other cavities. The number, therefore, should not be regarded as an indication of the egg potential.

Some of the deposited eggs were collected from the ground and the periphery of the orifice, and placed in an aquarium containing water from the cavity. Many *A. triseriatus* and *O. signifera* larvae were in the water. The eggs hatched, and eventually three females and two males emerged. The males were identified as *T. rutilus*.

The random arrangement of deposited eggs of *T. rutilus* was observed about the same cavity twice during the summer of 1955. Between 11:00 a.m. and 2:00 p.m. on March 16, 1956, eight eggs of the species were neatly stacked in a cluster on the surface of water in a small cavity, eight feet above the ground, in water oak. The cavity contained about 500 ml. of water, which had a copper tint. Thirty-two *A. triseriatus* and thirteen *O. signifera* larvae, all in the first instar, were present. It was evident that the eggs had been deposited while the female was in a stationary position.

Because the basal part of the orifice projected a maximum of four inches from the trunk, the limited space may not have permitted an aerial deposition.

The time required for the development of immature stages of *T. rutilus* is often long. Jenkins and Carpenter (1946) reported the larval stage to last as long as six months, and the pupal stage to require from four to five days under natural conditions. Basham *et. al.* (1947) reared a male in 20 days from a larva collected in the first instar. They also observed that the pupal stage required from four to five days. Under observation by the writer, eight eggs deposited in a small cavity in a water oak containing *A. triseriatus* and *O. signifera* larvae hatched in 24 to 48 hours. With the orifice covered by a layer of cheesecloth the larval stage was completed in 22 days, and the pupal stage in six days by a male. The development period from deposition to emergence required 30 days.

## Summary

From 1954 to 1955 the writer examined routinely 19 tree holes in the area of Gainesville, Florida. Larvae of *T. rutilus* were found in three cavities in sweetgum trees, and in a cavity in water oak.

*T. rutilus* was observed in the act of depositing eggs while in flight, and this has been described. It was evident that the species also deposits eggs while in a resting position.

Under natural conditions the time required for a male to develop from the egg stage to an adult was 30 days.

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# OBSERVATIONS OF INSECTICIDAL CONTROL BY SURFACE ACTIVE AGENTS

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Soaps were early and widely used for insect control. A quotation from Sanderson and Pearis (1931) gives a very brief resumé pertaining to soap: "Insecticidal soaps are the oldest of recognized insect destroyers. Almost any form of soap, if used in a strong enough mixture, will kill soft-bodied insects." With the advent of DDT and the later developed insecticides, however, emphasis has been placed on control with the newest and most powerful toxicants. These chemicals, however, have certain hazards and disadvantages which present some problems of usage. Human toxicity from application and from harmful residues are two prominent problems. Soaps and emulsifiers are accepted as safe materials for use by man. If these could be used for the removal or destruction of insects, especially of leafy vegetables such as turnip greens, celery and cabbage, it would be desirable.

Soaps and many other materials exhibit surface action which lowers or reduces surface tension. "Emulsifiers, detergents, wetting agents, penetrants and dispersants, are all specialized forms of surface active agents," according to Haller (1953). Modes of action or methods of kill of insects by soaps and other surface active agents is not understood. There may be a similarity of action of surface active agents with that of emulsifiable oils.

Emulsifiers were shown by earlier workers to give insect control and to assist toxicants to give control. New wetting agents for old insecticides were tested by Ginsburg (1935) whose objective was the improvement of wetting and spreading of contact insecticides. Aphids, *Macrosiphum solanifolii* (Ashm.) and *Myzus persicae* Sulz. were eradicated by Dozier (1937) on sweet potatoes by a single application of a sulphated fatted alcohol (Orvus WA Paste) by sprays of 1:64 by volume. He reported that it gave remarkable control of greenhouse red spider and effective control of flower thrips, mosquitoes, citrus white fly and greenhouse ants. Some review of the literature and reports of studies was given by Turner, et al (1951). They reported synergism with nicotine and low degrees of mortality with the polyethyleneglycol compounds tested. In studies on control of the tomato fruitworm in South Carolina, Chamberlain and Cochran (1955) recently reported, "The addition of sticking agents to the insecticide formulations increased the control about 80 percent but the excellent control obtained without their use would not justify recommending their use in a commercial program."

A formulation made by a local manufacturer which contained much emulsifier and small amounts of toxicants was tested for insect control. Tests with this material prompted further work with this and other emulsifiers. Results obtained appear worthy of publication. Although some interesting possibilities for the use of emulsifiers in insect control are evident, no recommendation is given. Although one product is named

repeatedly, other materials might have performed equally as well or possibly more effectively.

## Methods

All tests reported herein were made under field conditions except one, a laboratory test as is indicated. There were four or more replications in each test although small numbers of plants were often employed owing to the possibility of plant injury. These tests may be termed "exploratory" in character.

Several emulsifiers or surface active agents were tested. One material, Triton X-160, was early observed to be fully as safe to plants as any other tried and as effective as any other in reducing insect abundance. It is named in each table. Other emulsifiers were listed as "Test emulsifiers 1, 2, . . . n" since with many matrials the exact chemical was not known. Reports by the manufacturer, Rohm & Haas Company, on Triton X-160 state that it is a mixture of alkyl aryl polyether alcohols plus organic sulfonates.

Pressure type hand-pumped sprayers were used for applying most spray treatments. Power sprayers were used for some tests as is indicated below.

The first test conducted was made on turnips, variety Purple Top, in January, 1954. Cabbage aphids, *Brevicoryne brassicae* (L.), were counted 2, 5, and 11 days after the spray applications. The results are summarized in Table 1.

TABLE 1.—Comparative Numbers of Cabbage Aphids Per Plant on Turnips Sprayed with Test Materials.

| Material | Dilution of material with water, by volume | Days after treatment 2 | 5 | 11 |
|---|---|---|---|---|
| Test emulsifier 1 | 1:100 | 7.6 | 96.5 | 54.1 |
| do. | 1:50 | 42.0 | 45.8 | 36.8 |
| Test emulsifier 2 | 1:100 | 27.7 | 60.5 | 99.8 |
| do. | 1:50 | 0.4 | 15.5 | 44.5 |
| Test material of unknown contents No. 1 | 1:1 | 23.1 | 139.5 | 161.8 |
| Parathion, 4 lbs/gal. | ⅓ pt./100 gals. | 0.0 | 2.8 | 38.3 |
| Test emulsifier 3 | 8 lbs./100 gals. | 16.7 | 66.5 | 157.7 |
| Triton X-160 | 1:100 | 0.0 | 11.8 | 26.8 |
| Demeton, 2 lbs/gal. | 1 pt./100 gals. | 0.0 | 0.0 | 8.6 |
| Check | | 41.6 | 133.8 | 168.9 |
| "F" value for significance, | | | | |
| Found | | 1.9 | 3.5 | 2.2 |
| Required, 5% | | 2.3 | 2.3 | 2.3 |

Another planting of turnips was made for test purposes, January, 1954, and the results are summarized in Table 2.

TABLE 2.—Comparative Numbers of Cabbage Aphids Per Plant on Turnips Sprayed with Test Materials.

| Material | Dilution of material with water, by volume | Days after Treatment 3 | 11 | 18 |
|---|---|---|---|---|
| Triton X-160 | 1:100 | 4.4 | 11.3 | 36.4 |
| do. | 1:200 | 14.3 | 9.8 | 40.8 |
| do. | 1:400 | 9.0 | 17.5 | 57.4 |
| do. | 1:800 | 15.0 | 36.4 | 75.4 |
| Test emulsifier 4 | 1:400 | 15.0 | 48.1 | 134.9 |
| Demeton, 2 lbs/gal. | ½ pt./100 gals. | 1.0 | 8.8 | 27.2 |
| Parathion, 4 lbs/gal. Brand A | ⅓ pt./100 gals. | 0.3 | 4.5 | 19.8 |
| do. Brand B | ⅓ pt./100 gals. | 7.1 | 14.2 | 30.6 |
| Test emulsifier 5 | 1:200 | 10.8 | 92.0 | 250.0 |
| Check | | 11.8 | 133.3 | 219.2 |
| "F" value for significance, Found | | 2.2 | 2.8 | 2.9 |
| Required, 5% | | 2.3 | 2.3 | 2.3 |

TABLE 3.—Comparative Numbers of the Avocado Red Mite Per Leaf Dipped in Test Mixtures.

| Material | Dilution of material with water, by volume | Days after dipping 1 | 4 |
|---|---|---|---|
| Triton X-160 | 1:100 | 2.8 | 0.0 |
| do. | 1:200 | 5.0 | 1.4 |
| do. | 1:400 | 5.2 | 1.0 |
| do. | 1:800 | 3.8 | 0.0 |
| Kelthane, 2 lbs/gal. | 1 qt./100 gals. | 0.8 | 0.0 |
| Sulfur, wett. | 8 lbs/100 gals. | 8.2 | 0.8 |
| Demeton, 2 lbs/gal. | 1 pt./100 gals. | 0.0 | 0.8 |
| Aramite, 15% w.p. | 2 lbs/100 gals. | 0.6 | 0.0 |
| Ovex, 50% w.p. | 1½ lbs/100 gals. | 16.4 | 0.4 |
| Oil, emulsifiable | 1:100 | 0.0 | 0.0 |
| Genite, #923, 25% w.p. | 2 lbs/100 gals. | 2.4 | 0.2 |
| Chlorobenzilate, 2 lbs/gal. | 1 pt./100 gals. | 0.2 | 0.0 |
| Parathion, 4 lbs/gal. Brand A | ⅓ pt./100 gal. | 1.0 | 2.8 |
| do. Brand B | ⅓ pt./100 gal. | 7.6 | 4.6 |
| Test emulsifier 6 | 1:400 | 1.0 | 0.4 |
| do. 7 | 1:200 | 1.6 | 5.4 |
| Check | | 22.8 | 5.2 |
| "F" value for significance, Found | | 1.02 | 1.58 |
| Required, 5% | | 1.80 | 1.80 |

A statistical analysis of averages for all days gave a statistical "F" value of 3.0. Percentages of control for Triton X-160 were 86, 82, 77 and 65, respectively, for dilutions of 1:100, 1:200, 1:400 and 1:800. These assume a linear relationship by logarithmic—probit graphing.

The one laboratory study was conducted in January, 1954. Avocado leaves were taken from a tree of the Pollock variety. These leaves were infested with the avocado red mite, *Oligonychus yothersi* (McG.). The leaves were immersed singly in the material, then placed in vials of water to await results. A summary of the results is given in Table 3.

TABLE 4.—Average Numbers Per Sprout of the Cabbage Looper and the Cabbage Aphids on Brussels Sprouts, Five Days After Treatment.

| Material | Dilution of material with water, by volume | Average numbers of Cabbage looper | Cabbage aphid |
|---|---|---|---|
| Triton X-160 | 1.500:100 | 8.8 | 27.3 |
| do. | 0.750:100 | 5.2 | 37.0 |
| do. | 0.375:100 | 10.7 | 21.7 |
| DDT, 2 lbs/gal. emul. | 1 qt./100 gals. | 8.3 | 12.9 |
| Endrin 50% w.p. | ½ lb./100 gals. | 0.5 | 23.1 |
| Parathion + toxaphene 4 lbs./gal. 8 lbs./gal. | 6 fl. oz. + ½ pt./100 gals. | 3.3 | 71.4 |
| Thimet, 2 lbs./gal. | 1 pt. | 5.5 | 12.0 |
| Check | | 7.0 | 220.1 |
| "F" value for significance, Found | | 4.1 | 2.1 |
| Required, 5% | | 2.3 | 2.3 |

TABLE 5.—Comparative Numbers of Cabbage Loopers Per Plant on Cabbage Plants Five Days After Treatments.

| Material | Dilution of material with water, by volume | Average number of cabbage loopers/plant |
|---|---|---|
| DDT, 50% w.p. | 2 lbs./100 gals. | 1.1 |
| Endrin, 50% w.p. | ½ lb./per 100 gals. | 0.1 |
| Triton X-160 | 1:99 | 2.7 |
| Pyrenone | 1:39 | 0.8 |
| Methoxychlor 50% w.p. | 2 lbs./100 gals. | 0.9 |
| Ryania | dust | 0.2 |
| Check | | 1.7 |
| "F" value for significance, Found | | 4.9 |
| Required, 5% | | 3.2 |

TABLE 6.- Comparative Numbers of Florida Red Scales on Lime Leaves.

| Material | Dilution of material with water, by volume | Avg. No. scales per leaf |
|---|---|---|
| Parathion, 4 lbs/gal. + TEPP 20% | ¾ pt. + ¼ pt. | 1.8 |
| Parathion, 15% w.p. + oil 85% | 1½ lbs. + 3 qts. | 0.4 |
| Parathion 4 lbs/gal. + Triton X-160 | ½ pt. + 1 gal. | 0.2 |
| do. | ½ pt. + ½ gal. | 0.6 |
| do. | ½ pt. + ¼ gal. | 3.4 |
| Parathion 4 lbs/gal. | 1 pt. | 1.9 |
| Parathion 15% w.p. | 2 lbs. | 0.3 |
| Parathion 4 lbs/gal. + Test emulsifier 8 | ½ pt. + 2 qts. | 2.8 |
| Malathion 25% w.p. | 6 lbs. | 0.2 |
| Check | | 10.1 |
| "F" value for significance, Found | | 6.0 |
| Required, 5% | | 2.3 |

TABLE 7.—Comparative Numbers of *Macalla thyrsisalis* on Mahogany Twig Terminals.

| Material | Dilution of material with water, by volume | Avg. No. larvae per 20 twig terminals |
|---|---|---|
| Lead arsenate | 3 lbs/100 gals. | 4.0 |
| Triton X-160 | 1 pt./100 gals. | 5.8 |
| do. | ½ pt./ gals. | 13.3 |
| do. | ¼ pt./100 gals. | 18.0 |
| Calcium arsenate | 3 lbs. | 20.5 |
| Test emulsifier 9 | ½ pt. | 13.0 |
| Test material of unknown contents, No. 2 | ½ pt. | 2.3 |
| Endrin, 1½ lbs/gal. emul. | ½ pt. | 7.8 |
| Check | | 23.5 |
| "F" value for significance, Found | | 0.9 |
| Required, 5% | | 3.3 |

A planting of Brussels sprouts became infested with the cabbage looper, *Trichoplusia ni* (Hbn.) and the cabbage aphid, *Brevicoryne brassica* (L.), and was used in a test. Records obtained are summarized in Table 4.

A planting of cabbage was made in December, 1955, for determining control of the cabbage looper. The data are summarized in Table 5.

An experiment was conducted on lime trees with various materials for control of the Florida red scale, *Chrysomphalus aonidium* L. A power spray machine was used for applying the materials. A summary of the results is given in Table 6.

Mahogany, *Swietenia mahogani* Jacq., trees infested with larvae of a lepidopteran, *Macalla thyrsisalis* Wlk., were used in a test to determine control measures. This insect feeds on the leaves produced by the new spring growth and produces much webbing. Twenty twig terminals from each tree were examined two days after the spray treatments to determine any reduction in numbers of larvae. A summary of the results is given in Table 7.

Data on control of a red mite, probably *Oligonychus coiti* (McG.), on mango leaves by different spray materials were determined. Power spray equipment was used to apply the spray to seedling trees used in the test. Ten leaves from each tree were examined to measure control as summarized in Table 8.

TABLE 8.—Comparative Numbers of Red Mites on Mango Leaves.

| Material | Dilution of material with water, by volume | Avg. No. mites/leaf, days after treatment 7 | 66 |
|---|---|---|---|
| Chlorobenzilate, 25% w.p. | 2 lbs./100 gals. | 0.3 | 0.1 |
| Genite, EM-923, 50% | 1 pt./100 gals. | 9.2 | 2.0 |
| D-N, No. 1 40% | 11 oz./100 gals. | 49.6 | 5.1 |
| Aramite 15% w.p. | 2 lbs/100 gals. | 3.8 | 10.1 |
| AC-528, 25% w.p. | 1 lb/100 gals. | 0.0 | 0.0 |
| Triton X-160 | ½ gal./100 gals. | 1.1 | 3.2 |
| Oil, emulsifiable 87% | 3 qts./100 gals. | 12.4 | 2.3 |
| Ovex, 50% w.p. | 2 lbs/100 gals. | 1.7 | 0.0 |
| Sulfur, wettable | 8 lbs/100 gals. | 4.8 | 0.7 |
| Check | | 21.5 | 0.9 |
| "F" value for significance, | | | |
| Found | | 2.9 | 2.0 |
| Required, 5% | | 2.2 | 2.2 |

## Discussion and Summary

Reductions in numbers of insects and mites were found on plants treated by generally recognized toxicants and by certain emulsifying agents. Triton X-160, reported in each table, gave reduction in numbers of the cab-

bage aphid, red mites, larvae of *Macalla thyrsisalis* and in combination with parathion it increased reductions in the Florida red scale. There was no indication of any reduction of the cabbage looper. Varying dilutions of Triton X-160 usually varied the degree of reduction. More dilute sprays of the emulsifier induced less reduction than less dilute applications. Dilution rates and percentage control data transformed to logarithms and probits, respectively, showed linear relationships by graphic studies. Triton X-160 at 1:99 was phytotoxic to turnip and cabbage but other plants sprayed with it appeared uninjured.

Although the emulsifier Triton X-160 was tested more extensively than other surface active agents, others may be found that are equal or superior to it in effectiveness and in safety to plants. Some insects may succumb to emulsifier applications more readily than others. Tests will be necessary on many groups of insects in order to determine general effectiveness.

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## Correction of Minutes, 39th Annual Meeting of the Florida Entomological Society

Dr. Wilson's motion proposing the Sub-Tropical Entomologists of Florida become the Sub-Tropical Branch of The Florida Entomological Society was carried by unanimous vote.

Rorert O. Kirkland
*Secretary*

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# A NOTE ON THE BIOLOGY OF *SYNANTHEDON SAPYGAEFORMIS FLORIDENSIS* (GROTE) (LEPIDOPTERA: AEGERIIDAE)

ROGER A. MORSE[1]
Entomologist, State Plant Board of Florida, Gainesville

During March, 1956, Mr. L. J. Daigle, State Plant Board Inspector, sent in several galls taken from oak (Quercus sp.) in Miami. No insects had emerged from these galls and they were set aside under a bell jar. Shortly thereafter gall wasps, *Callirhytis batatoides* (Ashm.), emerged and were sent to the United States National Museum where they were identified by Dr. L. H. Weld. Gall wasps continued to emerge for about a week and after a lapse of about another week a moth, *Synanthedon sapygaeformis floridensis* (Grote), emerged from one of the galls. The moth was identified by Dr. J. F. Gates Clarke. The moth pupal case had been pulled part way out of the gall by the emerging moth, as shown in the photo. This note concerns the known life history of the moth.

Galls formed by *Callirhytis batatoides* (Ashm.). Both the gall wasps and the moth, *Synanthedon sapygaeformis floridensis* (Grote) emerged from these galls. Note the moth pupal case which was pulled part way out by the emerging moth. Photo by F. W. Mead.

Beutenmuller (1897) in discussing the family Sesiidae (now Aegeriidae) stated: "Larvae of the family are internal feeders, living on roots, stems or pith of plants, or under bark, solid wood or roots of trees." Some, it

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was stated, were inquilinous in the galleries or wounded places made by other insects. The moth had been taken several times by 1897 on oak trees, but its relationship with the gall wasp was not known at the time. Engelhart (1946) remarked that long series of this moth had been reared from cynipid galls, but no species of gall wasp were mentioned nor references cited. Furthermore, it was not mentioned whether moths and wasps had emerged from the same gall. Engelhart felt that there was only one moth brood a year. Observations (probably by Engelhart) indicated that moths emerged only from well-developed galls and developed only in galls with live tissue. He also stated that co-habitants of the gall frequently were ants and that no problems arose in the development of the moth as long as the pupal case remained intact.

Moth, gall wasps, and the galls have been placed in the collection of the State Plant Board of Florida at Gainesville.

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Additions to the United States List of Cicadellidae: Two leafhopper species, new to the United States, were collected recently by State Plant Board of Florida inspectors in Miami, Florida. Individuals of both species have been placed in the collections of the U. S. National Museum and the State Plant Board of Florida.

*Idona sexmaculata* (DeLong). Six specimens were collected by L. J. Daigle, March 20, 1956, on *Hibiscus* sp. These were identified by Dr. David A. Young, Jr. of the United States National Museum. In 1923, this species was described from specimens in Puerto Rico, and placed in the genus *Empoasca*. In 1952, Caldwell and Martorell placed it in the genus *Hybla*. The same year Young reclassified it to *Idona*.

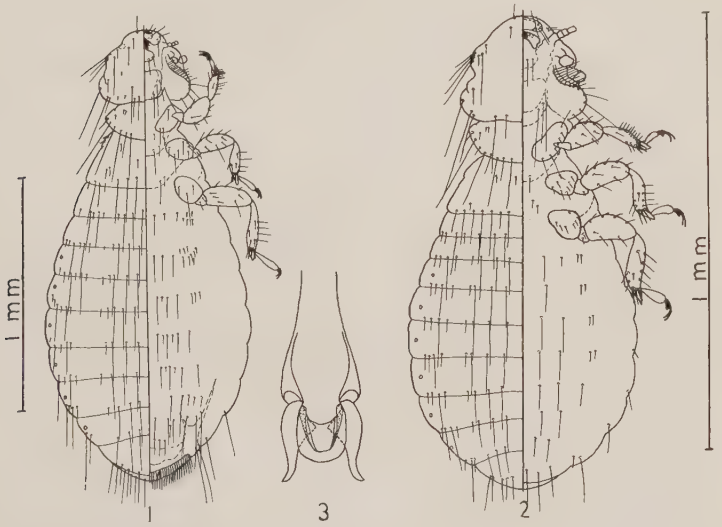
*Rabela tabebuiae* (Dozier). Four specimens were collected by C. F. Dowling, Jr., April 3, 1956, on African tuilp tree, *Spathodea campanulata* Beauv. Identification by D. A. Young, Jr. On March 18, 1957, L. J. Daigle collected *R. tabebuiae* on African tulip tree in North Miami Beach, reporting the abundance to be 4 per leaf. Identification by F. W. Mead. This species was described in the genus *Protalebra*, and has been reported from Cuba. Subsequently the insect has been recorded from the plant *Tabebuia* sp. and it now appears to be well established in the Miami area.

Frank W. Mead,
*Entomology Department*
*State Plant Board of Florida*

# A NEW SPECIES OF MALLOPHAGA FROM THE PIGEON

K. C. Emerson
Stillwater, Oklahoma

The Amblyceran genus *Bonomiella* Conci, 1942, contains two species found on doves and pigeons. The type host of *B. insolitunguicolata* Conci, 1942, is still unknown. The type host of *B. concii* Eichler, 1947, is *Streptopelia decaocto decaocto* (Frivaldszky). Specimens of this genus are rarely collected, there being fewer than ten known to be in collections. Males of the previously described species have still not been collected. From a careful examination of twenty-six domestic pigeons, the author was able to collect nine specimens representing a new species in the genus.




*Bonomiella columbae*, n. sp. fig. 1, dorsal-ventral view of female; fig. 2, dorsal-ventral view of male; fig. 3, male genitalia.

*Bonomiella columbae*, n. sp.

Male:—General shape and chaetotaxy as shown in figure 2. Male genitalia as shown in figure 3. The genital sac, not shown in figure 3, is armed with prominent teeth. The male is similar in general shape to the female, but much smaller. Chaetotaxy, especially of the abdomen, differers from that on the female.

Female:—General shape and chaetotaxy as shown in figure 1. The head is more elongated than in *B. insolitunguicolata*, and the preantennal margins more expanded than in *B. concii*. The anal corona is more definite and not so sparse as that found in *B. concii*. A small patch of short setae

in the posterior lateral angles of abdominal sternite I, is not present in *B. concii* or *B. insolitunguicolata.*

*Type host:* domestic pigeon.

*Type material:* Holotype male and allotype female collected December 1, 1956, at Leavenworth, Kansas, by K. C. Emerson are in the U. S. National Museum. Paratypes from the same series; and two females collected November 3, 1945, at Vancouver, British Columbia by G. J. Spencer.

KEY TO THE SPECIES OF MALLOPHAGA OCCURRING ON THE DOMESTIC PIGEON.

1. Maxillary palpi present ..... 2
   Maxillary palpi wanting ..... 4
2. Forehead armed ventrally with a pair of prominent spine-like Processes..... *Hohorstiella lata* (Piaget), 1880
   Forehead without ventral spine-like processes ..... 3
3. Venter of third femora with a comb of fine setae..... *Colpocephalum turbinatum* Denny, 1842
   Venter of third femora without a comb of fine setate..... *Bonomiella columbae*, n. sp.
4. Head longer than wide..... *Columbicola columbae* (Linnaeus), 1758
   Head wider than long ..... 5
5. Forehead armed ventrally with a pair of spine-like processes..... *Physconelloides zenaidurae* (McGregor), 1917
   Forehead without ventral spine-like processes..... 6
6. Antennae filiform and similar in both sexes..... *Campanulotes bidentatus compar* (Burmeister), 1838
   Antennae sexually dimorphic; in the male, first segments enlarged, second and third segments elongated, and fourth and fifth segments greatly reduced..... *Coloceras damicorne fahrenholzi* Eichler, 1950

## LITERATURE CITED

*Conci, C.* 1942. Un nuovo genere di Somaphantidae, ascrivibile ad una nuova sottofamiglia (Mallophaga-Liotheida). Riv. Soc. Stud. Venezia Tridentina, 23: 1, 5 figs.

*Eichler, W.* 1947. Über einen seltenen Tauben-Federling, *Bonomiella concii* nov. spec. Tierärztliche Umschau, 2: 264, 5 figs.

# HONEY BEES AND THE MEDITERRANEAN FRUIT FLY SPRAY PROGRAM[1]

ROGER A. MORSE[2] AND FRANK A. ROBINSON[3]

Since the start of the Mediterranean fruit fly spray program, we have received several inquiries from beekeepers and entomologists concerning the hazards of the bait sprays to honey bees in the sprayed areas. In this paper we are attempting to present all the information we have gathered during the eight months the spraying operations have been under way.

The first question confronting us was whether or not the baits being used in the sprays would attract honey bees. Five pounds of the N.B.C. yeast hydrolysate, and five pints of Staley's Sauce Base No. 2 were obtained from the Florida State Plant Board and tests made to determine whether they were attractive to honey bees. The yeast bait was mixed with a 50 percent sugar solution at the rate of 2 pints per gallon of syrup and the mixture was sprayed on rows of cantaloupe plants. Other rows were sprayed with a 50 percent sugar solution, without the bait. Observations and counts were made of the number of honey bees visiting the treated plants. No difference in numbers of bees was observed, and it was concluded that the yeast bait did not attract honey bees to any significant extent. Staley's Sauce Base No. 2 was mixed with sugar syrup at the rate of two pints per gallon of syrup. Two feeders, one containing plain sugar syrup and one containing syrup with the sauce bait added, were placed in each of several colonies of bees. In all cases, the feeder containing the plain sugar syrup was emptied in a shorter time than the one containing syrup plus sauce bait. Tests also were made with open pans of sugar syrup and sugar syrup plus sauce bait placed fifty yards away from a hive of bees. Here again there was no significant difference in the time it took the bees to find the pans or in the number of bees attracted to them. From these tests it was concluded that the sauce bait does not have any attraction for honey bees.

After it was determined that these baits did not attract honey bees, the information was passed on to beekeepers with the prediction that any damage which might occur to honey bees would not be serious and probably would be confined to those bees which happened to fly through the spray as it was being applied. With possibly one exception, this was correct, only seven or eight complaints having been received from beekeepers claiming damage from the aerial sprays. Of these reports, only four have been definitely confirmed as spray injury, and in only one case was the loss great enough to be considered important.

The first reported injury came from a beekeeper who had three colonies located within the city limits of Miami. The area in which the bees were located was sprayed four times with the malathion bait spray (1 qt. sauce bait, 2 pounds of 25% malathion wettable powder per 1 gallon of water applied at the rate of one gallon per acre). All bee loss occurred from

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[1] Florida Agricultural Experiment Station Journal Series, No. 601.

[2] Roger A. Morse, Entomologist, Florida State Plant Board.

[3] Frank A. Robinson, Assistant Apiculturist, Florida Agricultural Experiment Station.

the third spraying. The beekeeper stated that on this application the plane passed over the apiary site twice, at about 10:00 o'clock in the morning, and that the bees were in flight at the time. Two of the three hives had 200-300 dead bees in front of the entrance, and even though the third hive showed no signs of injury, we have little doubt that this loss resulted from the aerial spray. All three colonies were thoroughly examined and no losses or injury other than those mentioned were noted. A sample consisting of about 200 bees was sent to the Beekeeping and Insect Pathology Section of the United States Department of Agriculture in Beltsville, Maryland. These bees were collected three days after the actual loss had occurred. A. S. Michael of the above laboratory made this and subsequent examinations and reported that no evidence of toxic materials could be found.

The second report of injury came from Haines City and was made by a staff member of the Citrus Experiment Station. The loss came at a time when bees were working off-season orange bloom. In this case, too, the loss occurred from only one spraying. This loss was not investigated by us since we did not receive the report until several weeks after it actually occurred.

The third report of damage came from a beekeeper at Kissimmee. In this instance an apiary of about 20 colonies was involved. This case was investigated by Mr. John Haynie, extension apiculturist, who reported finding about 500 dead bees in front of each colony. The beekeeper sent a sample of the dead bees to the Beltsville Laboratory immediately after a spray application in the area. The shipment was delayed in transit and was received in Beltsville five days after it was taken. Residue determinations in this case also were negative.

Early in December, 1956, the extension apiculturist informed us that a beekeeper in the Tampa area had reported serious damage to his bees due to the aerial sprays. On December 10, we visited Mr. Alec White, Hillsborough County Agent, who told us that at the last meeting of the Tampa Bay Beekeepers' Association, several beekeepers had reported that their bees were being injured by the Mediterranean fruit fly sprays. Mr. White also told us that before the spray program started in this area he offered to give the beekeepers advance notice of the spraying schedule so colonies could be moved, but so far no beekeeper has asked for this information.

With the assistance of Mr. Charlie Griffin, Apiary Inspector for the area, we inspected 76 colonies owned by one beekeeper in Tampa. All of these colonies seemed to be in good condition. Each colony contained from two to five frames of brood, well covered with bees, and from 30 to 60 pounds of honey. Though these colonies appeared to be in very good condition, the owner said they had produced only about half as much honey, and had only half as many bees, as they normally do in that location. We found from 200-500 dead bees scattered several feet in front of each hive, and while we feel certain that the majority of these were killed by the aerial sprays, 20-25 percent were drones which are normally driven from the hives at that time of year.

We also talked with a hobbyist beekeeper in Tampa who had seven colonies in one location. He reported that all the bees in five colonies were killed within 24 hours after one aerial spray application. As this incident had occurred several weeks earlier, we were unable to verify this claim;

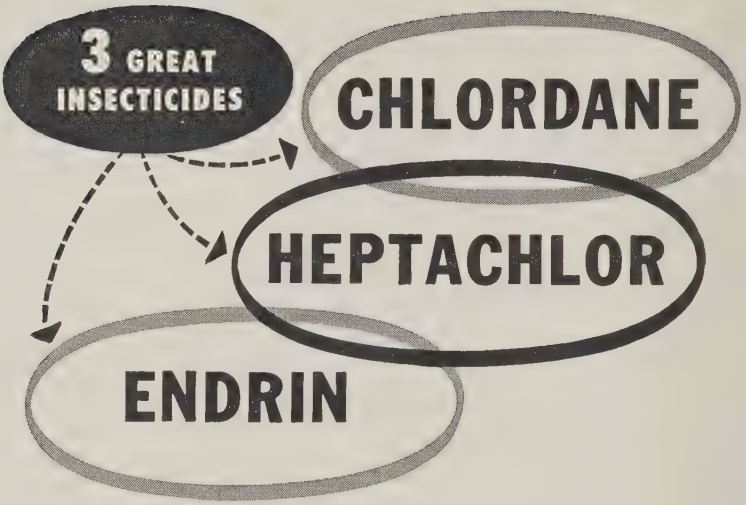
however, since two colonies in the group reportedly were not injured at all, we remain unconvinced that the damage was due to the spray.

It is interesting to note that two colonies of bees operated by Dr. E. G. Kelsheimer at the Gulf Coast Experiment Station in Bradenton have not been noticeably affected by the aerial sprays. Nineteen spray applications were made over this location during the period from June 28, 1956 through December 6, 1956. The first eight applications were made by single engine planes, using the formula noted above, on a ten-day schedule. The remaining applications were made by multi-engined planes using 1.2 pounds of 25 percent malathion wettable powder and one pint of sauce base in one gallon of water. This was applied at the rate of one gallon per acre on a seven-day schedule. In spite of these repeated sprayings, the colonies have continued to gain weight. When we examined them on December 10, they were very populous and in excellent condition.

During July and August, the State Plant Board had in their employ a beekeeper in South Florida who had 200 colonies in areas being sprayed at ten-day intervals. Periodic examination of these bees showed no loss. During this same period, six of the eight State Plant Board Apiary Inspectors were working in or near areas being sprayed. Each man inspects about 2,000 colonies per month. No abnormal bee losses have been reported by these men since the beginning of the program.

After considering how few reports of injury to bees have been made and the fact that repeated aerial spraying has caused no visible damage, we feel that the Mediterranean fruit fly spray program has not caused any serious damage to the beekeeping industry at this time. However, it should be pointed out that some of the losses which have occurred in the Tampa area would have been more serious if they had occurred just before or during a major honey flow, since the bees killed by the spray are the field bees which are gathering nectar or pollen.

At this time, no one knows just how intensive the aerial spraying operations will be at the time of the citrus nectar flow. It is believed that areas requiring treatment during the citrus bloom will be relatively small and few in number. If this proves to be true, it should be possible for the beekeepers to move from these areas and thus avoid the risk of having their bees destroyed.

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**HEPTACHLOR:** Alfalfa Snout Beetle, Alfalfa Weevil, Ants, Argentine Ant, Armyworms, Asiatic Garden Beetle Larvae, Black Vine Weevil, Root Maggots, Clover Root Borer, Colorado Potato Beetle, Corn Rootworms, Cotton Boll Weevil, Cotton Fleahopper, Cotton Thrips, Crickets, Cutworms, Egyptian Alfalfa Weevil, European Chafer, Eye Gnats, False Wireworms, Flea Beetles, Garden Webworm, Grasshoppers, Japanese Beetle, Leaf Miners, Lygus Bugs, Mormon Cricket, Mosquitoes, Narcissus Bulb Fly, Onion Maggot, Onion Thrips, Rapid Plant Bug, Rice Leaf Miner, Salt Marsh Sand Fly, Seed Corn Maggot, Spittlebug, Strawberry Root Weevils, Strawberry Rootworms, Sugar Beet Root Maggot, Sweet Clover Weevil, Tarnished Plant Bug, Tuber Flea Beetle, Western Harvester Ant, White Fringed Beetles, White Grubs (June Beetles), Wireworms ...and many others.

**ENDRIN:** Budworms, Cabbage Worms, Cotton Boll Weevil, Cotton Bollworm, Cotton Fleahopper, Fall Armyworm, Grasshoppers, Hornworms, Leafworms, Rapid Plant Bug, Spiny Bollworm, Sugar Beet Webworm, Tarnished Plant Bug, Thrips.

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# NOTES ON THE BIOLOGY OF *STURMIA INCOMPTA* (VAN DER WULP) AND *WINTHEMIA CITHERONIAE* SABROSKY (DIPTERA: LARVAEVORIDAE)

CONSTANCE NICHOLAS PATTON [1]

At eleven o'clock on the morning of October 10, 1955, I watched a female *Sturmia incompta* (Wulp) deposit eggs on a fourth instar larva of *Pholus fasciatus* Sulzer. The host was smaller and brighter than average and probably was newly molted. The eggs apparently were of the membranous type, with fully developed larvae, and were easily seen when first deposited. Later that same afternoon, after eclosion of the larvae, the choria shrivelled considerably and were easily detached from the host integument.

Presumably the parasites immediately began burrowing through the floor of their choria into the host, for the caterpillar thrashed about in an attempt to crush the maggots with its mandibles. The fly also had appeared to annoy the larva, and only her agility enabled her to avoid the larva.

On October 16, the host larva went into the soil. Four days later the host, in moribund condition, had developed a putrid odor, and several holes were apparent in its integument. It had not transformed to the pupal stage.

The soil was sieved on October 31, and the parasite pupae, grouped together, were brushed lightly with a camel's hair brush to remove dirt before storage. Immediately, the flies began emerging, and expanded normally. The stimulus to emergence may have been provided by the cleaning process, although this had not been the case in numerous other rearings.

An interesting variation in this instance was the parasites' emergence from the larval host rather than from the pupal stage. This might be attributed to the eggs having been laid on a young host, or to variations caused by laboratory rearings.

Eleven adults were reared, the life cycle from egg to adult requiring 21 days.

Normally, the parasites overwinter as small larvae, probably second instar, associated with the tracheae near a spiracle in the host pupa.

In October, 1954, numerous *Pholus fasciatus* larvae were collected on evening primrose (*Jussiaea* sp.). They pupated shortly thereafter and appeared normal throughout the winter.

On March 1, 1955, one of the pupae which had wriggled normally ten days before was examined again. It had split at the junction of the thorax with the abdomen and was devoid of body contents. The parasite puparia, 20 in number, were found grouped near the escape aperture, with their spiracles pointing into the air space surrounding the host pupal case. On March 16, fifteen flies emerged. The remaining puparia were examined several days later and found to contain fully formed dead imagoes.

[1] Garden City, Michigan.

A mature *Eacle ismperialis* larva was collected on November 7, 1955, from pine. It had 25 oblong, macrotype eggs glued to segments 2, 7 and 8. The larva fed sparingly and went into the ground on November 10. Five days later, it had transformed into a perfect, vigorous pupa.

The cast larval skin was examined, and most of the eggs had hatched, eclosion being accomplished through a split at one end on a horizontal plane.

On the morning of November 18, the pupa was dead, and two splits were observed between abdominal segments. Parasite larvae were seen through the splits, all of them pointing toward the posterior end of the pupa. They were immersed in decomposing body contents of the host. Their spiracles were in contact with the air space near the aperture.

Most larvae were still feeding on November 20, but several were disturbed by my probing and crawled down into the soil immediately. By noon of the following day, all parasites had entered the soil.

The host pupal case contained remains of at least three larvae and single and "community" funnels. These community funnels were formed by the junction at their origin of several individual funnels. They are unique in this respect among those I have observed.

Fly puparia were scattered throughout the soil, mostly in the area directly below the host pupa.

On December 5, six male *Winthemia citheroniae* Sabrosky emerged. The following day, three additional males and four females emerged. Since only 13 of the parasites completed pupation and emergence, approximately 50 per cent must have perished from such causes as failure to hatch before the host transformed, starvation, over-crowding, or perhaps from contact with the molting fluid of the host.

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